**Janeen Nelson**

Class: ***Water, Energy, and Waste: Integrating Themes of Sustainability into your Classroom***

Midterm: October 22, 2011

Relevance of Lesson:

Grade 3 and 4

**NYC Scope and Sequence**

[Unit 3: Properties of Water: ***What makes water so special?***

Observe, describe, and explore the physical properties of water: PS 3.1a,b ;PS 3.1c,d,

Explore how different factors affect evaporation. PS 2.1c; PS 3.2a,b,c; LE 6.2c

Describe the Water Cycle. PS 2.1c; LE 6.2c]

**Danielson’s Framework: Competency 3c: Engaging Students in Learning**

Lesson: **Rain Machine [Solar Still]**

**Adapted from:** The Energy Education & Workforce Development Site [Florida Solar Energy Center]

**Objective:**

1. **Students will be able to explain a simple way to desalinate water using solar energy.**
2. **Students will understand the evaporation and condensation process, and relate it to the water cycle on Earth.**

**Grade Level:** 3rd and 4th

Grade Level Expectation: Student understands the stages of the water cycle and how it is influenced by temperature and land features

**Vocabulary:**

condensation – the changing of a gas or vapor into its liquid form; a reduction to a denser form as from steam to water

evaporation – to change into a vapor or gas; the process of changing into vapor

desalinization – the process of removing salt and other chemicals and minerals from water

purify – to remove undesirable elements or impurities; to make something pure or clean

solar still – a device that uses solar energy to evaporate a liquid

**Time:** 1 hour to build still and discuss

**Materials:**

* bowl (one per group)
* plastic cup, 1" shorter than sides of bowl or cut to size (one per group)
* clear plastic food wrap
* tape or rubber band large enough to go around bowl (one per group)
* small rock or weight (one per group)
* salty water

**Background Information**

Stills are commonly used to purify liquids. Through the process of distillation, nonvolatile impurities can be separated from the liquid. Distillation can be a simple process–heat is first added to a liquid to evaporate it and produce a gas or vapor. Heat is then removed from the vapor to condense it back to a liquid.

A solar still uses the greenhouse effect to trap energy from the Sun. The solar still is a model of the water cycle on earth: evaporation, condensation, precipitation.

**Procedure: (prior to class)**

1. Make a solar still as an example to the class.

**Procedure: (during class)**

1. Lead the class in a discussion of desalination.

Questions that might be asked:

Have you ever tasted salt water? Can we drink it?

How could we make seawater drinkable? (Take the salt out of it)

1. Tell the class that they are going to experiment with a ‘solar sill’, a simple way to use evaporation to make salty water drinkable.
2. Divide the class into working groups of 2 - 3 students per group.
3. Explain the procedure to the class:

* salty water will be put in the bowl
* the cup will be placed in the middle of the bowl
* plastic wrap will be pulled tightly over the top of the bowl and secured with either a rubber band or tape
* a weight will be put in the center of the plastic wrap above the cup so that the evaporated water will drip into the cup.

diagram of solar still

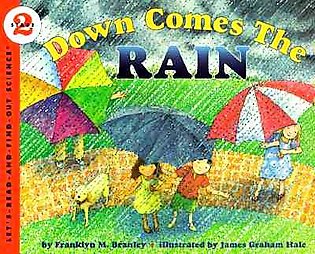
1. Pass out the materials.
2. Help students during the construction process.
3. Place the solar stills in full sun.
4. Write “evaporation” on the board. Lead a discussion on what evaporation is and when they have seen it occur.
5. Check the still’s progress as often as you desire, in ½ hour increments. Point out the small water droplets on the inside of the plastic wrap. Solar stills can be left out for several days if desired.
6. Taste the water in the cup. Ask the students if it tastes different than their tap water (yes). Why does the water taste different than tap water?
7. Lead a discussion of evaporation and desalination.
8. Students will log all stages of the experiment in their science journals.
9. Students will complete science journal page. [see attached]

**Further Research**

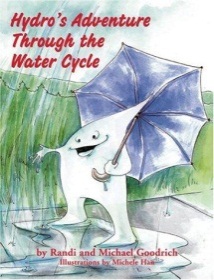
1. Is rain colorless? Try your solar still with colored water or tea. Does the color evaporate and condense into the center container?
2. Can you use a still to remove the water from a solution? Is there water in your milk (or juice)? Put milk or another liquid in your solar still and see what happens.
3. Put together a classroom terrarium (with a lid) to make further observations about the water cycle.

**Related Reading :**

* **Down Comes the Rain (Let’s-Read-and-Find-Out Science 2**) by Franklyn Branley and James Hale. This book is a concise and informative look at the water cycle. Branley provides a fundamental understanding of how water is recycled, how clouds are formed, and why rain and hail occur. A few easy science activities are included.



* **Hydro’s Adventure Through the Water Cycle** by Randi Goodrich and Michael Goodrich This book tells the story of Hydro, a wise and whimsical water molecule who travels through a never-ending water cycle crisscrossing the skies, sliding down mountains, and evaporating into a cloudy mist. Deftly embedded within the text of a charmingly told tale is basic information on how the earth's water cycle works; who is affected by the earth's water cycle; and the challenges that confront the water cycle.



Assessment Rubric for Participation

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| **Evaporation, Condensation and Desalinization** | | | | | |
|  | **Poor** **1pt** | **Fair** **2pts** | **Good** **3pts** | **Score** |  |
| **Definition/Explanation of Terms** | Poor  Cannot accurately convey meanings and/or explanations of the water cycle and the processes of evaporation and condensation. | Fair  Can define and explain the water cycle, condensation and the role the evaporation process plays within the water cycle. | Good  Communicates the definitions and explanations of the water cycle, condensation and evaporation process. Accurately applies these processes to events in everyday life/nature. | Score |  |
| **Collection of data** | Poor  Does not demonstrate understanding how to correctly use equipment in lab or the process of recording data independently. | Fair  Demonstrates knowledge of the correct use of lab equipment and can record the data with some instruction. | Good  Displays understanding of the use of lab equipment including what adaptation to equipment can be made. Can accurately collect data with no instruction. | Score |  |
| **Journal summary** | Poor  Provides little to no accurate information on the water cycle, the evaporation process, or the importance of the evaporation process. Did not communicate in the summary what factors directly affect evaporation. Poor grammar and spelling are present within the summary. | Fair  Illustrates precise facts concerning the water cycle/evaporation process as well as the importance of the evaporation process. Gives an example of how one factor may have an impact on the evaporation process. Uses proper grammar and spelling. | Good  Proficient in the conveyance of information relating to the water cycle and evaporation process. Gives examples of the importance of the evaporation process. Shows how various factors have an impact on the process of evaporation. Use of proper grammar and spelling is in place. | Score |  |

Solar Matters II Science Journal

Rain Machine (Solar Still)

1. Where did the water droplets on the plastic wrap come from?

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1. What happens to the rain on the sidewalk after the sun comes back out?

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1. What do you think would have happened to the water in the bowl if the bowl wasn’t covered with the plastic wrap?

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1. What energy source was used in this device [solar still]?

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1. Where might we apply this idea on a large scale? Think about the world around you.

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